Technology Opportunity

On-line, Real-Time Gas Analysis for Process Control

The National Aeronautics and Space Administration (NASA) seeks to transfer a nonintrusive gas analysis and monitoring technology that allows multiple gases to be monitored simultaneously.

Potential Commercial Uses

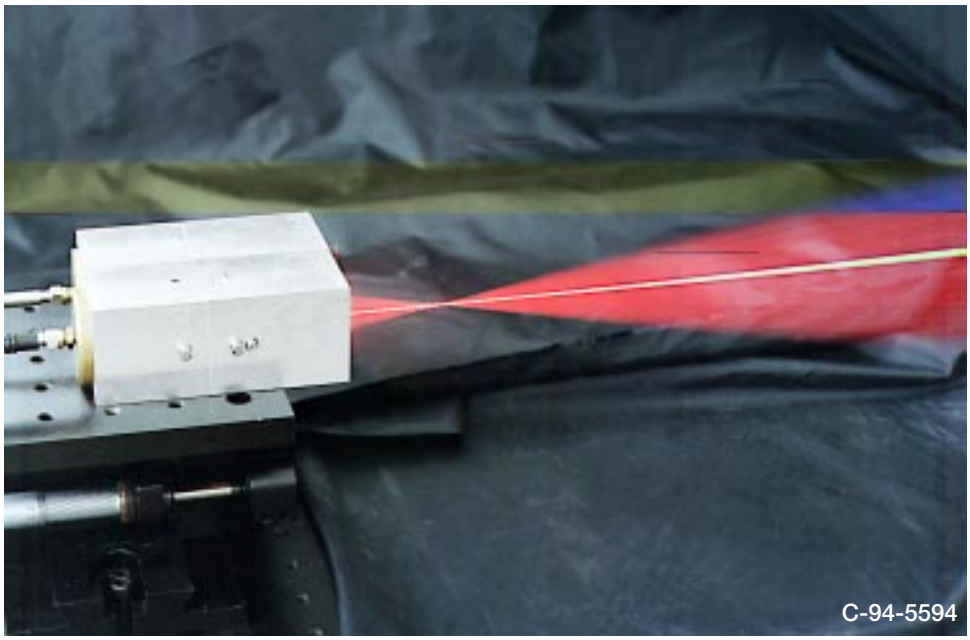
- Endothermic gas composition monitoring in metal heat-treating plants
- Monitoring for decay products in the food industry
- Leak detection
- Environmental monitoring
- Gas separation monitoring
- Combustion monitoring

Benefits

- Provides cost savings by improving fuel economy
- Improves overall economy by reducing product rejection rate
- Improved process control facilitates environmental compliance
- Permits early detection of a process malfunction
- Allows access to high-temperature, corrosive environments because of its remote, nonintrusive character

The Technology

The green light of an argon ion laser is focused onto the gas to be analyzed or monitored. The molecules



Operational gas monitoring probe.

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in the gas scatter the light in many different wavelengths (colors). Some of these wavelengths depend on the internal energy structure of the molecules and thus indicate a specific molecule. Collecting and analyzing the scattered radiation by wavelength gives information about the type and quantity of the species present. Real-time analysis of the intensities at these wavelengths allows quantitative monitoring of the gas composition.

An instrument has been designed that allows real-time, in situ monitoring of the gas. It consists of an enclosure that houses a laser and the data acquisition equipment, and a small (10 $in.^3$) optical probe. The probe is connected to the housing by optical fibers that transmit laser light to the probe and the collected light, scattered from molecules, back to the data acquisition equipment. The probe can be mounted on an endothermic gas line or other location to monitor gas compositions.

The scattered light is separated from ambient light by means of intensity modulation. Before the laser light is coupled into the delivery fiber, it is modulated with an optical chopper at about 400 Hz. The light that is scattered and collected also exhibits this modulation. The collected light is spectrally separated and detected with a photomultiplier tube (PMT). A lock-in amplifier processes the PMT signal, separating the modulated light from other light that contaminates the signal. The resulting wavelength-dependent intensities are proportional to the gas species present. The instrument output is a voltage that is a direct readout of the species concentration.

Options for Commercialization

One of NASA's missions is to commercialize its technology. The NASA Lewis Research Center's aim is to commercialize the process-monitoring technology described herein. The commercialization potential for such gas monitoring appears to be significant. This gas-monitoring technology could be used by the metal heat-treating, food-processing, gas-separation, environmental-compliance-testing, and automotive industries. To encourage commercialization, the Lewis Commercial Technology Office is actively working with two interested industrial partners to test and evaluate the gas-monitoring technology in industrial applications. Initial field testing in a metal heat-treating plant provided promising results. Any company wishing to license the gas-monitoring technology may do so provided it has a sound business plan with a high potential for success.

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Key Words

Process control
Gas monitoring
Real-time gas analysis
Raman scattering technology
Nonintrusive diagnostics

M-0239-66

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